9-3-00 A

type a plus sign (+) inside this box →

PTO/SB/05 (4/98)
Approved for use through 09/30/2000 OMB 0651-0032
Patent and Trademark Office U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

03/31/00 C780 U.S. PTO

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1 53(b))

Attorney Docket No.	042390.P6729
First Inventor or Application Identifier	Scott A. Rosenberg
Title	SYSTEM AND METHOD FOR REFRESHING IMAGING DEVICES OR DISPLAYS ON A PAGE-LEVEL BASIS
Express Mail Label No.	EL466333716US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

jc678 U.S. PTO 09/540166 03/31/00

1. ☒ Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)

2. ☒ Specification [Total Pages 13]
(preferred arrangement set forth below)
- Descriptive title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings (*if filed*)
- Detailed Description
- Claim(s)
- Abstract of the Disclosure

3. ☒ Drawing(s) *(35 U.S.C. 113)* [Total Sheets 5]

4. Oath or Declaration [Total Pages 4]
a. ☒ Newly executed (original copy)
b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d)) *(for continuation/divisional with Box 16 completed)*
i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR §§ 1.63(d)(2) and 1.33(b).

5. ☐ Microfiche Computer Program *(Appendix)*

6. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
a. ☐ Computer Readable Copy
b. ☐ Paper Copy (identical to computer copy)
c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. ☐ Assignment Papers (cover sheet & document(s))
8. ☐ 37 C.F.R. § 3.73(b) Statement *(when there is an assignee)* ☐ Power of Attorney
9. ☐ English Translation Document *(if applicable)*
10. ☐ Information Disclosure Statement (IDS)/PTO - 1449 ☐ Copies of IDS Citations
11. ☐ Preliminary Amendment
12. ☐ Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
13. ☐ *Small Entity Statement(s) ☐ Statement filed in prior application, Status still proper and desired
14. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
15. ☐ Other: .....

NOTE FOR ITEMS 1 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28).

16. **If a CONTINUING APPLICATION,** *check appropriate box, and supply the requisite information below and in a preliminary amendment:*
☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No: _____
Prior application Information: Examiner _____ *Group/Art Unit:* _____

For CONTINUATION or DIVISIONAL APPS only. The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

☐ Customer Number or Bar Code Label (Insert Customer No. or Attach bar code label here) or ☒ Correspondence address below

Name	BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP				
Address	12400 Wilshire Boulevard, Seventh Floor				
City	Los Angeles	State	California	Zip Code	90025
Country	U.S.A.	Telephone	(714) 557-3800	Fax	(714) 557-3347

Name (Print/Type)	William W. Schaal, Reg. No. 39,018		
Signature		Date	03/31/00

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231.

Atty. Docket No.: 042390.P6729
Express Mail No.: EL466333716US

APPLICATION FOR UNITED STATES PATENT

FOR

SYSTEM AND METHOD FOR REFRESHING IMAGING DEVICES OR DISPLAYS ON A PAGE-LEVEL BASIS

Inventor(s):

SCOTT A. ROSENBERG
RICHARD W. JENSEN

Prepared by:

BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP
12400 Wilshire Boulevard, Seventh Floor
Los Angeles, California 90025-1026
(714) 557-3800

BACKGROUND

1. Field

This invention generally relates to the field of cathode ray tubes (CRTs).

2. Background

Traditional display systems target a cathode ray tube (CRT) as their final imaging device. A CRT is typically updated in a raster fashion and require frequent refresh of the image being displayed in order to avoid perceived flickering by the user. Updating and refreshing the CRT in such manner is highly inefficient.

A new class of non-raster based imaging devices, including but not limited to liquid crystal displays (LCD), currently exists. These non-raster based imaging devices are typically "active matrix" devices, where pixels on the devices can be individual accessed and modified through the use of one or more switches at each pixel. The individual accessibility of pixels on these non-raster based imaging devices allows the pixels to be randomly turned on or off in a non-raster fashion. However, this updating and refreshing technique is inefficient as well.

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1A and 1B show exemplary systems in accordance with the current invention.

Figure 2 shows an exemplary image frame.

Figures 3A and 3B illustrate embodiments of memory configurations representing an image frame.

Figure 4 illustrates the concept of temporal coherence.

Figure 5 is a flow diagram outlining the process of performing a drawing operation to fully or partially generate an image.

Figure 6 is a flow chart outlining the process employed to refresh or update the imaging device or display.

DESCRIPTION

The present invention provides a system and method for refreshing imaging devices or displays on a page-level basis.

Figure 1A shows an exemplary system in accordance with the current invention. The "system" includes, but is not limited or restricted to a computer (e.g., desktop, laptop, hand-held, etc.). The system 100 includes a bus 105 coupling together general purpose microprocessor 110, graphics processor 115, display controller 120, and memory controller 125. It should be noted that the system 100 can also include multiple graphics processors 115_1 ... 115_N as shown in Figure 1B, where "N" is a positive integer. Memory controller 125 is operatively coupled to memory 130 to control read and write accesses to memory 130. Display controller 120 is operatively coupled to image device or display 135 to control read and write accesses to imaging device or display 135.

The drawing of images or visual information can be performed by general purpose microprocessor 110, by graphics processor(s) 115, or by a combination of general purpose microprocessor 110 and graphics processor(s) 115. Representations of images or visual information are typically deposited into image frames stored in memory 130. As will be described later, memory 130 is divided into memory pages in support of well-known memory paging schemes. Display controller 120 periodically reads the image frames stored in memory 130 and sends these image frames to imaging device or display 135 for presentation.

Figure 2 shows an exemplary image frame 200. The image frame 200 is typically divided into tiles $205_{0,0}$...$205_{X,Y}$, where "X" and "Y" are positive integers. Each tile represents $205_{0,0}$...$205_{X,Y}$ a two-dimensional region of pixels of the image frame. Images 210, 215, 220 can span over multiple tiles, as shown in Figure 2. However, images can also be contained within a tile. In accordance with the present invention and as discussed

below, the content of each tile $205_{0,0}$...$205_{X,Y}$ is deposited in one memory page to take advantage of the spatial coherence generally demonstrated by drawing operations to improve the drawing speed. "Spatial coherence" refers to the concept that a drawing operation is more likely to create or modify a pixel that is close to the last pixel that was created or modified than to create or modify a randomly chosen pixel.

Figure 3A illustrates one embodiment of a memory configuration representing an image frame 300. The illustrated memory configuration is referred to as the "Packed-RGB" configuration. As stated above and illustrated in Figure 2, each image frame is divided into tiles. The content of each tile is stored in a memory page 310_1, 310_2,..., 310_M, where "M" is a positive integer. In the Packed-RGB configuration, RGB-color components $305_{0,0}$, $305_{0,1}$ of one pixel are deposited or packed together in contiguous location in memory. Furthermore, color components of contiguous pixels of a tile are deposited or packed contiguously. For example, color components $305_{0,0}$ of the pixel located at coordinate (0,1) of a tile can be stored in memory next to color components $305_{0,1}$ of the pixel located at coordinate (0,0) of the same tile. In addition, color components of pixels located within one tile of the image frame are stored within the same memory page.

Figure 3B illustrates an alternative embodiment of a memory configuration representing an image frame 300. The illustrated memory configuration is referred to as the "Multi-Plane" configuration. In the Multi-Plane configuration, the content of each image frame 300 is deposited in three color planes, including (1) red plane (R-plane) 315, (2) green plane (G-plane) 320, and (3) blue plane (B-plane) 325. RGB-color components of pixels are separated and deposited in corresponding color planes. Accordingly, red (R) components 330 are deposited in the R-plane 325; green (G) components 335 are deposited in the G-plane 320; and blue (B) components 340 are deposited in the B-plane 315.

Each color plane 315, 320, 325 includes multiple memory pages. As stated above and illustrated in Figures 2, each image frame is divided into tiles. The content of each tile is stored in a memory page. Furthermore, color components of contiguous pixels are deposited or packed contiguously in the appropriate color plane. In addition, color components of pixels located within one tile of the image frame are stored within the same memory page in the appropriate color plane.

In one embodiment, memory pages having a size of 4-Kilobyte (Kbyte) is employed. In this embodiment, each 4-Kbyte memory page can hold the content of tiles having a dimension of 64 pixels by 64 pixels. In this embodiment, accesses within a tile of 64 pixels by 64 pixels falls accordingly within the same memory page. It should be noted, however, that memory pages having sizes other than 4-Kbyte can be used.

As stated above and shown in Figures 1A and 1B, the drawing of images can be performed by general purpose microprocessor 110, by graphics processor(s) 115, or by the combination of microprocessor 110 and the graphics processor(s) 115. Representations of images or visual information are generated and deposited into image frames. Each image frame is divided into tiles. The content of each tile is stored in one memory page. Display controller 120 periodically reads the image frames and sends these image frames to the display or imaging device for presentation. Display controller 120 sends these image frames to the display one memory page at a time for efficiency purposes.

In most image applications, temporal coherence occurs. Temporal coherence refers to the concept that over some period of time, the content of a majority of the tiles of image frames generated consecutively over time would typical remain the same. Figure 4 illustrates the concept of temporal coherence. For example, tile (0,0) 405_1, 405_2, 405_3 remains unchanged from the first image frame 400_1, to the second image frame 400_2, and to the third image frame 400_3.

Accordingly, to improve the efficiency of the process of updating or refreshing the display or imaging device, display controller 120 (shown in Figures 1A and 1B) employs a process where only modified pages are sent to the imaging device for representation.

Figure 5 is a flow chart outlining the process of performing a drawing operation. In block 510, images or visual information are generated, and the content of image frames used to store those generated images are updated. In block 515, memory pages corresponding to the tiles that have been updated due to the generation of the image or visual information are marked as being "modified" or "dirty".

Figure 6 is a flow chart outlining the process employed to refresh or update the imaging device or display with only memory pages that have been modified, known as "dirty" memory pages. In block 610, the current memory page is initialized to be the first memory page of the image frame. In block 615, if the current memory page has been marked as "modified" by a drawing operation, as shown in Figure 5 and described in the accompanying text, the current memory page is sent to the display or imaging device to be presented (block 620). The current memory page is then marked as "unmodified" (block 625). If the current memory page has not been marked as "modified", the memory page is sent to the display or imaging device only if the display or image device requires an update or refresh (block 630). In block 630, a query is performed to determine whether the last memory page of the image frame has been processed. If the last memory page of the image frame has not been processed, the current memory page is set equals to the next memory page in the image frame (block 635). The sequence of actions in blocks 615 to 625 are then repeated. If the last memory page of the image frame has been processed, the process of refreshing or updating the display or imaging device is then completed.

It should be noted that the functional components illustrated in Figures 1A and 1B and discussed above may be implemented in hardware or software. If the aforementioned functional components are implemented as a software program, the functionality of these components can be emulated by one or more sub-programs, which can be stored on a system-readable medium, such as floppy disk, hard drive, CD-ROM, digital video disk, tape, memory, or any storage device that is accessible by the system.

While certain exemplary embodiments have been described and shown in the accompanying drawings, it is to be understood that such embodiments are merely illustrative of and not restrictive on the broad invention, and that this invention not be limited to the specific constructions and arrangements shown and described, since various other modifications may occur to those ordinarily skilled in the art.

What is claimed is:

1. A system to refresh a display, the system comprising:

a memory to store at least one image frame such that content of the image frame is stored in a plurality of memory pages in the memory; and

a display controller in communication with the memory to access the image frame and to send the image frame one memory page at a time to the display to refresh the display.

2. The system of claim 1 further comprises a processor to perform drawing operations to generate images for the image frame, the processor marking memory pages corresponding to regions of the image frame that have been updated.

3. The system of claim 2, wherein the display controller sends only the marked memory pages of the image frame to the display.

4. The system of claim 1, wherein the image frame is divided into tiles representing two-dimensional regions of the image frame, each of the tiles is stored in one separate memory page.

5. The system of claim 1, wherein each of the memory pages has a size of four Kilobytes.

6. The system of claim 1, wherein the image frame is represented by a configuration where color components of a pixel are deposited in contiguous memory locations.

7. The system of claim 1, wherein the image frame is represented by a configuration where color components of a pixel are separated and deposited in multiple color planes.

8. A method to refresh a display, the system comprising:

storing at least one image frame such that content of the image frame is stored in a plurality of memory pages in a memory; and

sending the image frame to the display one memory page at a time to refresh the display.

9. The method of claim 8 further comprises marking memory pages corresponding to regions of the image frame that have been updated while performing drawing operations.

10. The method of claim 9, further comprises sending only the marked memory pages of the image frame to the display.

11. The method of claim 8 further comprising:

dividing the image frame into tiles representing two-dimensional regions of the image frame; and

storing each of the tiles in one separate memory page.

12. The method of claim 8 further comprises using memory pages of four Kilobytes in size.

13. The method of claim 8 further comprises organizing the image frame using a configuration where color components of a pixel are deposited in contiguous memory locations.

14. The method of claim 8, further comprises organizing the image frame using a configuration where color components of a pixel are separated and deposited in multiple color planes.

15. A program embodied on a system-readable medium to refresh a display, comprising:

a first sub-program to control storing at least one image frame in a memory such that content of the image frame is stored in a plurality of memory pages in the memory; and

a second sub-program to access the image frame and to send the image frame one memory page at a time to the display to refresh the display.

16. The program of claim 15, further comprising a third sub-program to mark memory pages corresponding to regions of the image frame that have been updated while performing drawing operations.

17. The program of claim 16 further comprising a fourth sub-program to send only the marked memory pages of the image frame to the display.

18. The program of claim 15 further comprising:

a third sub-program to divide the image frame into tiles representing regions of the image frame and to store each tile in a separate memory page.

19. The program of claim 15 further comprising:

a third sub-program to organize the image frame using a configuration where color components of a pixel are deposited in contiguous memory locations.

20. The program of claim 15 further comprising:

a third sub-program to organize the image frame using a configuration where color components of a pixel are separated and deposited in multiple color planes.

ABSTRACT

The present invention provides a system and method for checking authorization of remote configuration operations. The method comprises storing at least one image frame such that content of the image frame is stored in a plurality of memory pages in a memory. The method further comprises sending the image frame to the display one memory page at a time to refresh the display.

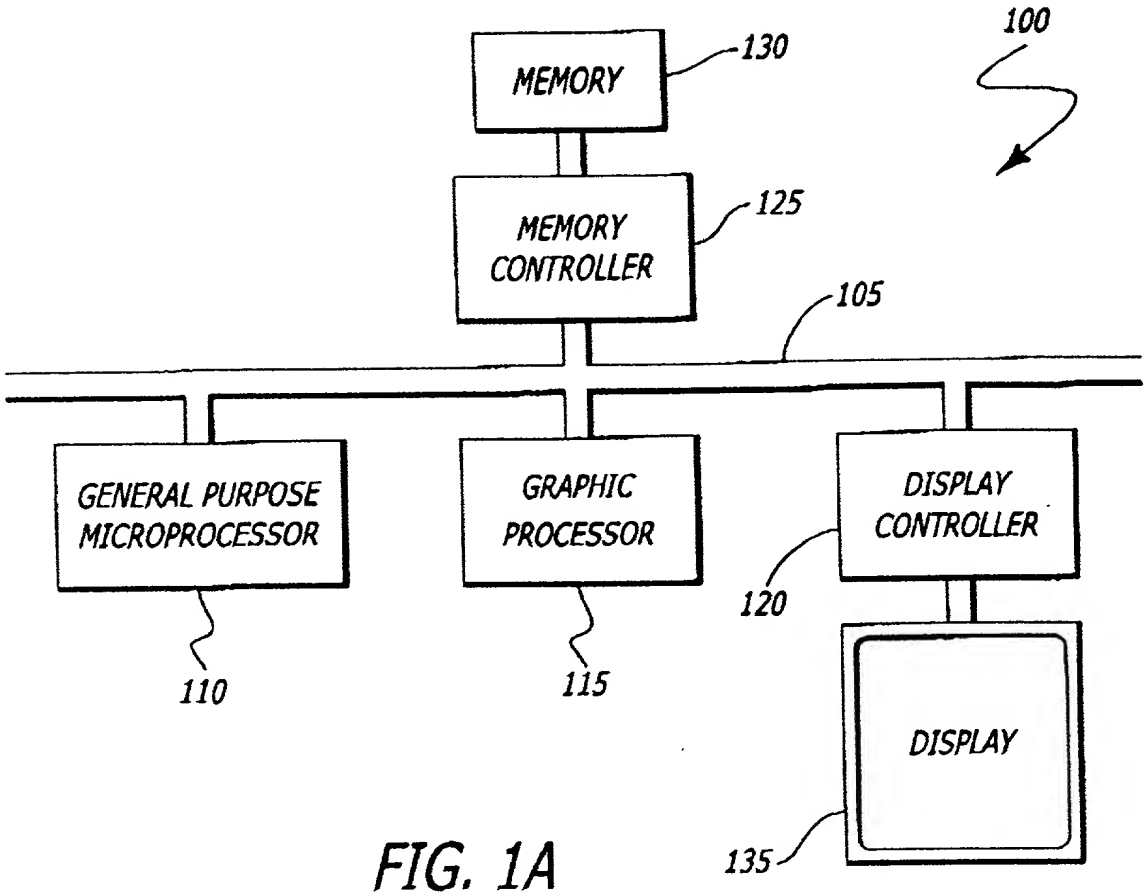
MEMORY
130
100
MEMORY CONTROLLER
125
105
GENERAL PURPOSE MICROPROCESSOR
GRAPHIC PROCESSOR
DISPLAY CONTROLLER
120
110
115
DISPLAY
135

FIG. 1A

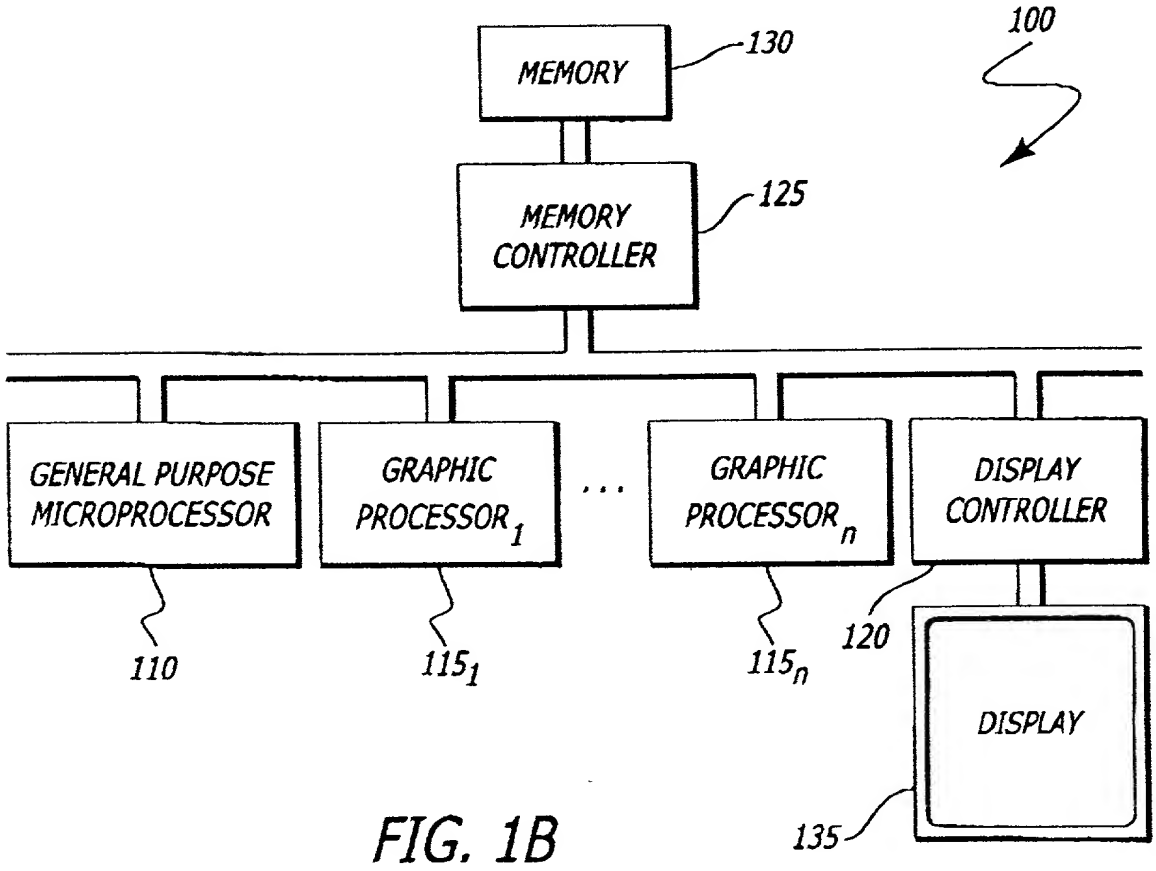
MEMORY
130
100
MEMORY CONTROLLER
125
GENERAL PURPOSE MICROPROCESSOR
GRAPHIC PROCESSOR 1
...
GRAPHIC PROCESSOR n
DISPLAY CONTROLLER
120
110
115 1
115 n
DISPLAY
135

FIG. 1B

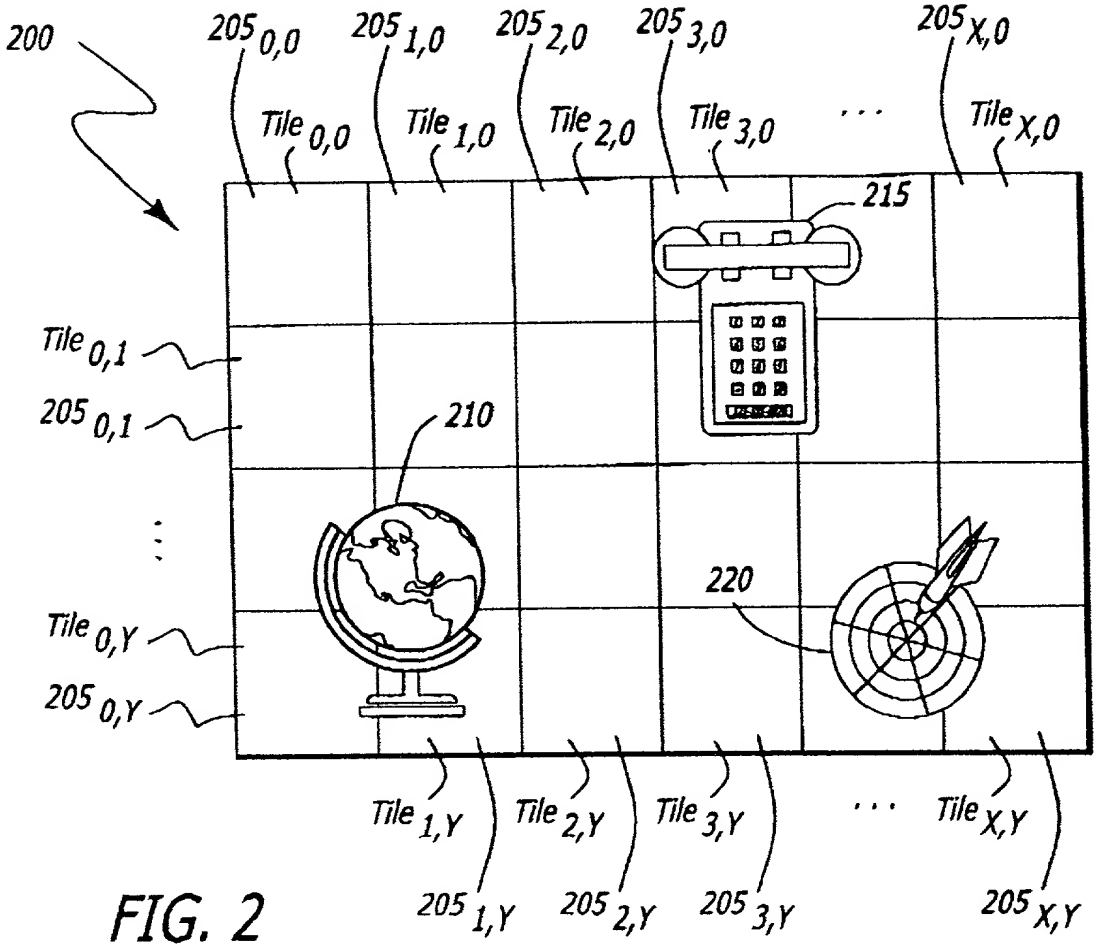
200
205 0,0
205 1,0
205 2,0
205 3,0
205 X,0
Tile 0,0
Tile 1,0
Tile 2,0
Tile 3,0
Tile X,0
215
Tile 0,1
205 0,1
210
220
Tile 0,Y
205 0,Y
Tile 1,Y
Tile 2,Y
Tile 3,Y
Tile X,Y
205 1,Y
205 2,Y
205 3,Y
205 X,Y

FIG. 2

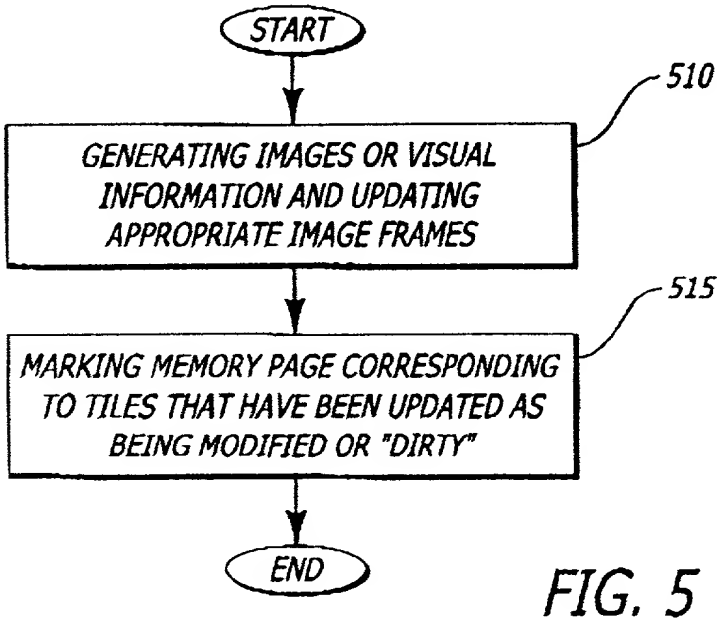
START
510
GENERATING IMAGES OR VISUAL INFORMATION AND UPDATING APPROPRIATE IMAGE FRAMES
515
MARKING MEMORY PAGE CORRESPONDING TO TILES THAT HAVE BEEN UPDATED AS BEING MODIFIED OR "DIRTY"
END

FIG. 5

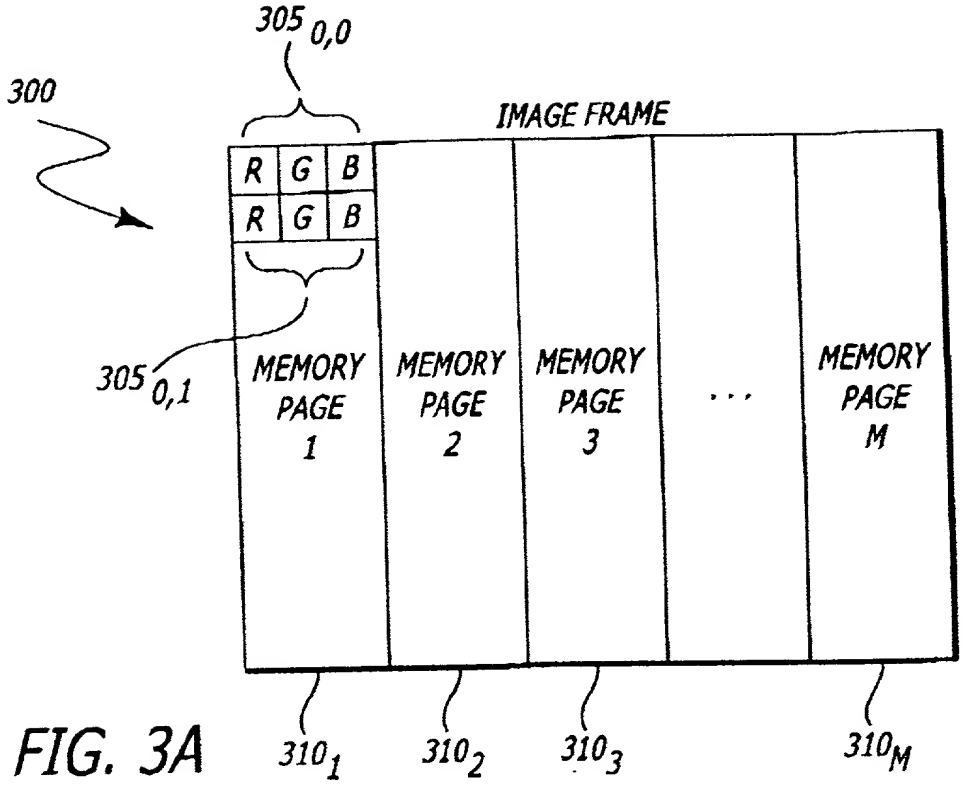
300
305 0,0
IMAGE FRAME
R G B
R G B
305 0,1
MEMORY PAGE 1
MEMORY PAGE 2
MEMORY PAGE 3
...
MEMORY PAGE M
310 1
310 2
310 3
310 M

FIG. 3A

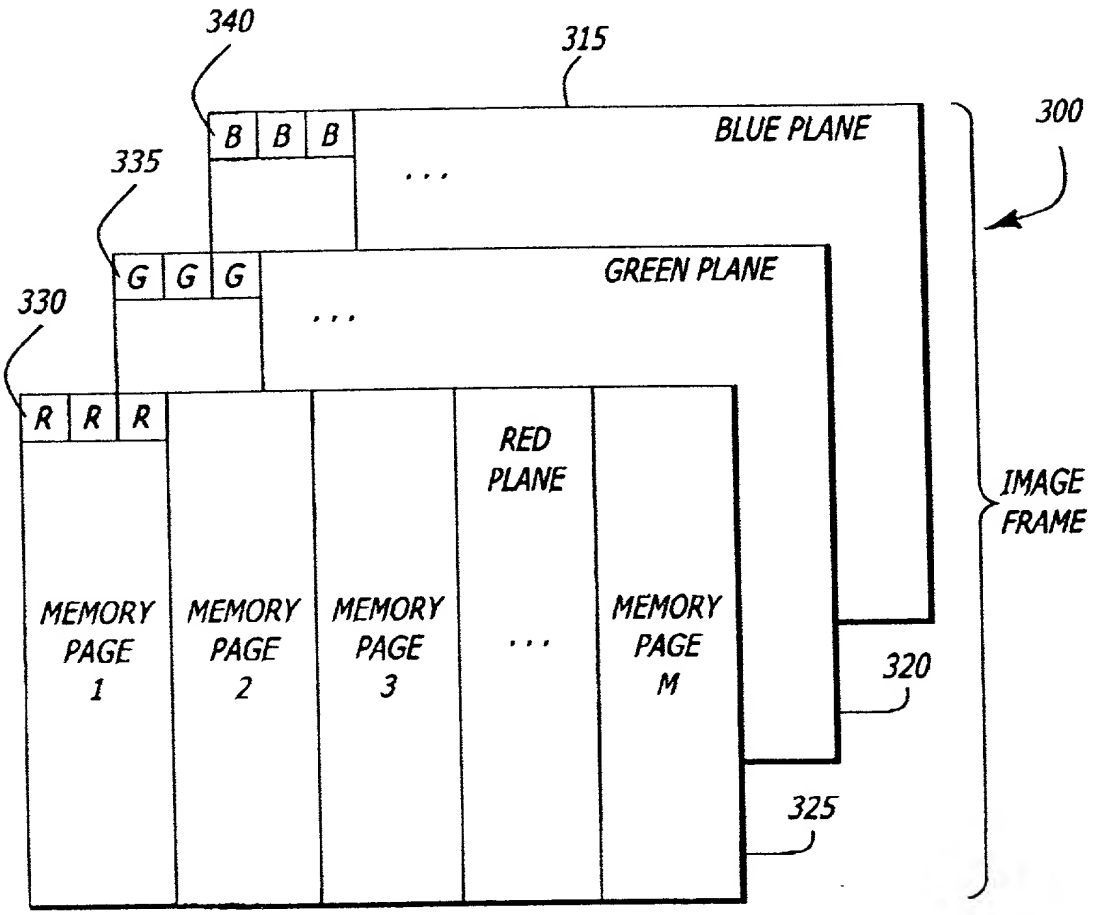
340
315
B B B
BLUE PLANE
300
335
G G G
GREEN PLANE
330
R R R
RED PLANE
MEMORY PAGE 1
MEMORY PAGE 2
MEMORY PAGE 3
...
MEMORY PAGE M
320
325
IMAGE FRAME

FIG. 3B

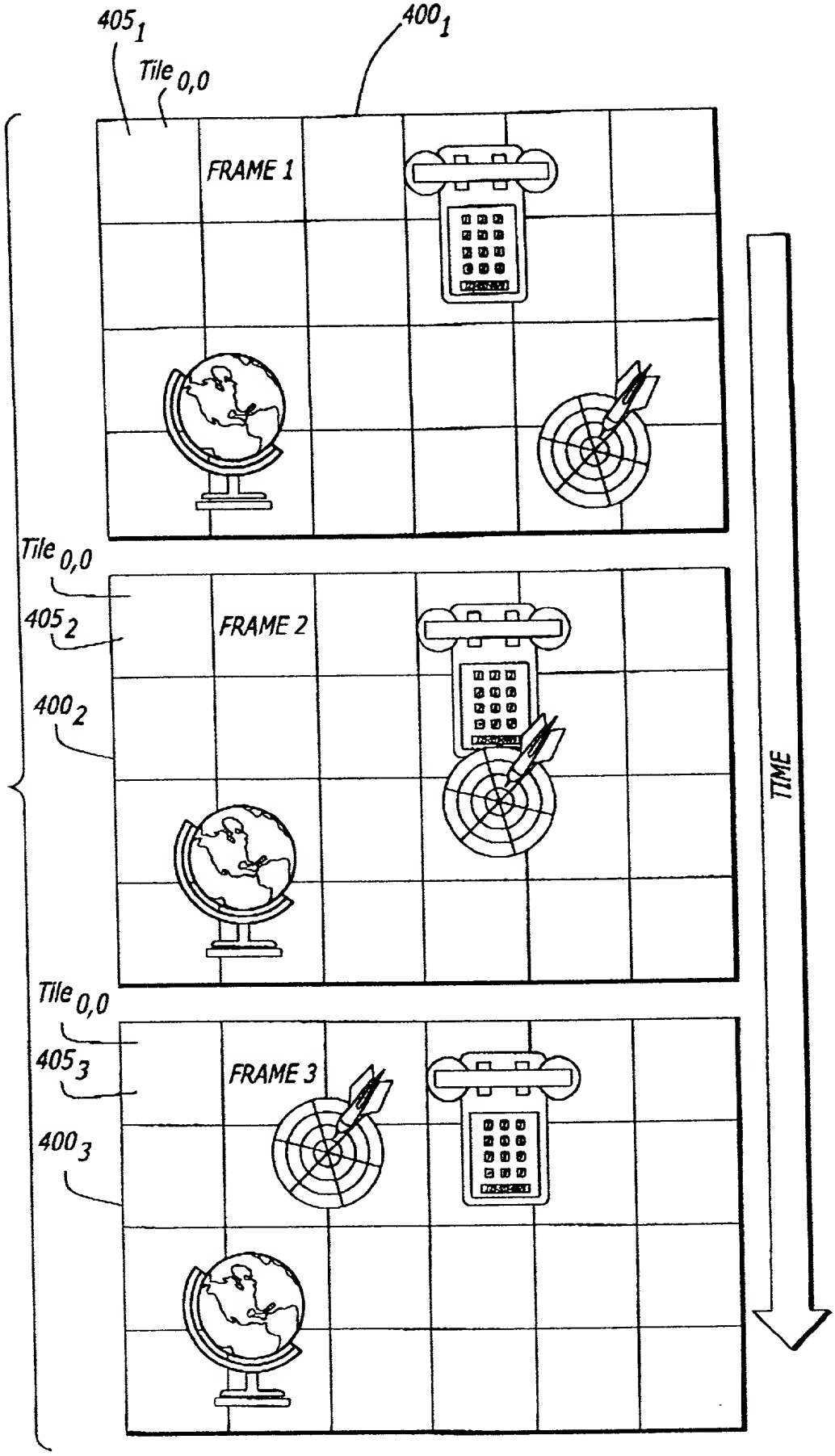
405_1
400_1
Tile $_{0,0}$
FRAME 1
Tile $_{0,0}$
405_2
FRAME 2
400_2
Tile $_{0,0}$
405_3
FRAME 3
400_3
TIME

FIG. 4

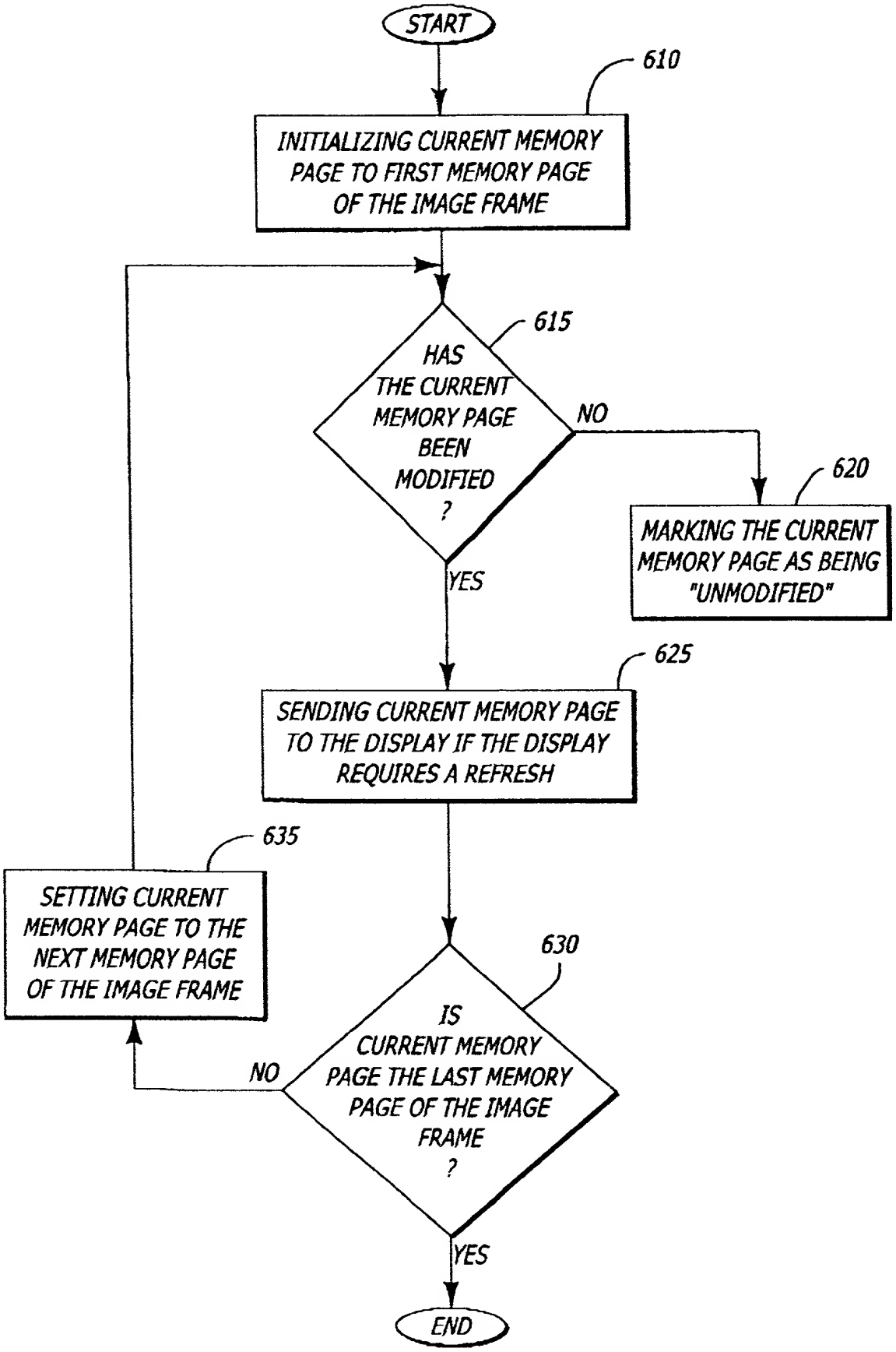
START
610
INITIALIZING CURRENT MEMORY PAGE TO FIRST MEMORY PAGE OF THE IMAGE FRAME
615
HAS THE CURRENT MEMORY PAGE BEEN MODIFIED ?
NO
620
MARKING THE CURRENT MEMORY PAGE AS BEING "UNMODIFIED"
YES
625
SENDING CURRENT MEMORY PAGE TO THE DISPLAY IF THE DISPLAY REQUIRES A REFRESH
635
SETTING CURRENT MEMORY PAGE TO THE NEXT MEMORY PAGE OF THE IMAGE FRAME
630
IS CURRENT MEMORY PAGE THE LAST MEMORY PAGE OF THE IMAGE FRAME ?
NO
YES
END

FIG. 6

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION (FOR INTEL CORPORATION PATENT APPLICATIONS)

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

SYSTEM AND METHOD FOR REFRESHING IMAGING DEVICES OR DISPLAYS ON A PAGE-LEVEL BASIS

the specification of which

[X] is attached hereto.
[ ] was filed on _____ as
United States Application Number _____
or PCT International Application Number _____
and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):

APPLICATION NUMBER	COUNTRY (OR INDICATE IF PCT)	DATE OF FILING (day, **month**, year)	PRIORITY CLAIMED UNDER 37 USC 119
			☐ No ☐ Yes
			☐ No ☐ Yes
			☐ No ☐ Yes

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below:

APPLICATION NUMBER	FILING DATE

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION NUMBER	FILING DATE	STATUS (ISSUED, PENDING, ABANDONED)

I hereby appoint the persons listed on Appendix A hereto (which is incorporated by reference and a part of this document) as my respective patent attorneys and patent agents, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

Send correspondence to:
William W. Schaal, Reg. No. 39,018, BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN, LLP
(Name of Attorney or Agent)
12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025 and direct telephone calls to:
William W. Schaal, (714) 557-3800.
(Name of Attorney or Agent)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole/First Inventor (given name, family name) **Scott A. Rosenberg**

Inventor's Signature _____ Date _____

Residence Palo Alto, California USA (*City , State*) Citizenship USA (*Country*)

P. O. Address 875 Univ. Avenue #9

Palo Alto, California 94301-2132 USA

Full Name of Second/Joint Inventor (given name, family name) ~~Sam~~ Richard W. Jensen

Inventor's Signature _____ Date Mar 23, 2000

Residence Fair Oaks, California USA (City, State) Citizenship USA (Country)

P. O. Address 8842 Winding Way #634

Fair Oaks, California 95628 USA

Full Name of Third/Joint Inventor (given name, family name)

Inventor's Signature _____ Date _____

Residence _____ (City, State) Citizenship _____ (Country)

P. O. Address _____

Full Name of Fourth/Joint Inventor (given name, family name)

Inventor's Signature _____ Date _____

Residence _____ (City, State) Citizenship _____ (Country)

P. O. Address _____

Full Name of Fifth/Joint Inventor (given name, family name)

Inventor's Signature _____ Date _____

Residence _____ (City, State) Citizenship _____ (Country)

P. O. Address _____

APPENDIX A

I hereby appoint BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP, a firm including: William E. Alford, Reg. No. 37,764; Farzad E. Amini, Reg. No. 42,261; Amy M. Armstrong, Reg. No. 42,265; Aloysius T. C. AuYeung, Reg. No. 35,432; William Thomas Babbitt, Reg. No. 39,591; Carol F. Barry, Reg. No. 41,600; Jordan Michael Becker, Reg. No. 39,602; Bradley J. Bereznak, Reg. No. 33,474; Michael A. Bernadicou, Reg. No. 35,934; Roger W. Blakely, Jr., Reg. No. 25,831; Gregory D. Caldwell, Reg. No. 39,926; Ronald C. Card, Reg. No. 44,587; Thomas M. Coester, Reg. No. 39,637; Donna Jo Coningsby, Reg. No. 41,684; Michael Anthony DeSanctis, Reg. No. 39,957; Daniel M. De Vos, Reg. No. 37,813; Robert Andrew Diehl, Reg. No. 40,992; Matthew C. Fagan, Reg. No. 37,542; Tarek N. Fahmi, Reg. No. 41,402; George L. Fountain, Reg. No. 36,374; Paramita Ghosh, Reg. No. 42,806; James Y. Go, Reg. No. 40,621; James A. Henry, Reg. No. 41,064; Willmore F. Holbrow III, Reg. No. 41,845; Sheryl Sue Holloway, Reg. No. 37,850; George W Hoover II, Reg. No. 32,992; Eric S. Hyman, Reg. No. 30,139; William W. Kidd, Reg. No. 31,772; Sang Hui Kim, Reg. No. 40,450; Eric T. King, Reg. No. 44,188; Erica W. Kuo, Reg. No. 42,775; Michael J. Mallie, Reg. No. 36,591; Paul A. Mendonsa, Reg. No. 42,879; Darren J. Milliken, Reg. No. 42,004; Chun M. Ng, Reg. No. 36878; Thien T. Nguyen, Reg. No. 43,835; Thinh V. Nguyen, Reg. No. 42,034; Dennis A. Nicholls, Reg. No. 42,036; Lisa A. Norris, Reg. No. 44,976; Daniel E. Ovanezian, Reg. No. 41,236; William F. Ryann, Reg. No. 44,313; James H. Salter, Reg. No. 35,668; William W. Schaal, Reg. No. 39,018; James C. Scheller, Reg. No. 31,195; Jeffrey S. Smith, Reg. No. 39,377; Maria McCormack Sobrino, Reg. No. 31,639; Stanley W. Sokoloff, Reg. No. 25,128; Judith A. Szepesi, Reg. No. 39,393; Vincent P. Tassinari, Reg. No. 42,179; Edwin H. Taylor, Reg. No. 25,129; Joseph A. Twarowski, Reg. No. 42,191; Lester J. Vincent, Reg. No. 31,460; Glenn E. Von Tersch, Reg. No. 41,364; John Patrick Ward, Reg. No. 40,216; Charles T. J. Weigell, Reg. No. 43,398; James M. Wu, Reg. No. 45,241; Steven D. Yates, Reg. No. 42,242; and Norman Zafman, Reg. No. 26,250; my attorneys; and Andrew C. Chen, Reg. No. 43,544; Justin M. Dillon, Reg. No. 42,486; and John F. Travis, Reg. No. 43,203; my patent agents, of BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP, with offices located at 12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025, telephone (714) 557-3800, and Alan K. Aldous, Reg. No. 31,905; Robert D. Anderson, Reg. No. 33,826; Joseph R. Bond, Reg. No. 36,458; Richard C. Calderwood, Reg. No. 35,468; Jeffrey S. Draeger, Reg. No. 41,000; Cynthia Thomas Faatz, Reg No. 39,973; Sean Fitzgerald, Reg. No. 32,027; John N. Greaves, Reg. No. 40,362; Seth Z. Kalson, Reg. No. 40,670; David J. Kaplan, Reg. No. 41,105; Charles A. Mirho, Reg. No. 41,199; Leo V. Novakoski, Reg. No. 37,198; Naomi Obinata, Reg. No. 39,320; Thomas C. Reynolds, Reg. No. 32,488; Kenneth M. Seddon, Reg. No. 43,105; Mark Seeley, Reg. No. 32,299; Steven P. Skabrat, Reg. No. 36,279; Howard A. Skaist, Reg. No. 36,008; Steven C. Stewart, Reg. No. 33,555; Raymond J. Werner, Reg. No. 34,752; Robert G. Winkle, Reg. No. 37,474; and Charles K. Young, Reg. No. 39,435; my patent attorneys, and Thomas Raleigh Lane, Reg. No. 42,781; Calvin E. Wells; Reg. No. P43,256, Peter Lam, Reg. No. 44,855; and Gene I. Su, Reg. No. 45,140; my patent agents, of INTEL CORPORATION; and James R. Thein, Reg. No. 31,710, my patent attorney; with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.